



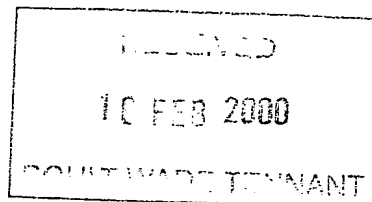
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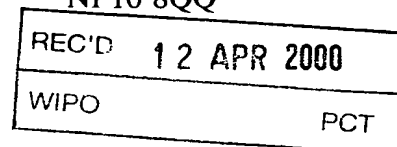
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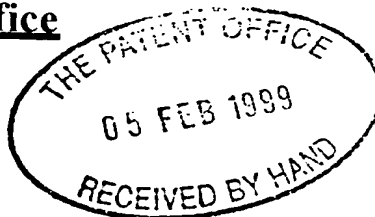
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2. Patent application number
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3. Full name, address and postcode of the or of each applicant (underline all surnames) **FOCAS LIMITED**
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United Kingdom

Patents ADP number (if you know it)

If the applicant is a corporate body, give the country/state of its incorporation

England and Wales

452607003

4. Title of the invention **PROTECTION OF DIELECTRIC CABLES**

5. Name of your agent (if you have one) **BOULT WADE TENNANT**
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Dr. Alex Frost

Date

5 February 1999

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DUPLICATE

PROTECTION OF DIELECTRIC CABLES

5 This invention relates to the protection of
dielectric cables, such as all dielectric self
supporting (ADSS) cables, when mounted adjacent
overhead power lines.

10 It has for some time been realised that the
national network of electricity pylons or towers which
carry overhead power lines also provides a convenient
location for telecommunications cables. Typically,
ADSS optical cables, carrying fibre-optic signals, are
15 strung between the towers in proximity with the high
voltage power lines.

 As will be well known to those skilled in the
art, ADSS cables generally comprise a bundle of fibres
encased in an insulating jacket. This jacket is
subject to physical degradation over periods of time,
20 ultimately resulting in damage to the signal-carrying
fibres within. One significant cause of this physical
degradation in the jacket is thought to be due to a
phenomenon known as dry band arcing.

 The ADSS cables are suspended from the towers by
25 a metal strap. Usually, the strap has preformed wires
that wrap around the cable to support it. However,
half shells may be employed instead; these clamp
snugly around the insulating jacket of the cable and
hold the cable in place relative to the towers.

30 Because the ADSS cables are mounted in proximity
to the high voltage overhead power lines, they
experience an electric field. This field can be
appreciable; for example it is common for ADSS cables
to experience an electric field of some 30kV when
35 mounted in proximity to a 400kV power line.

There is, therefore, an electric circuit created by the above arrangement. This comprises the high voltage power line, the capacitive coupling between this power line and the ADSS cable, and the path to
5 earth along the cable to the metal strap which connects the surface of the ADSS cable jacket and the tower, the tower and strap being substantially at ground potential.

When the ADSS cable is first installed, no
10 current flows around this circuit because the ADSS cable is a perfect dielectric (and thus has infinite resistance). As the jacket weathers, thus losing its natural hydrophobicity, and becomes contaminated with surface pollutants, however, currents begin to flow
15 around the circuit. Although the leakage currents flowing depend to a certain extent upon the surface resistance of the dielectric cable, they are fundamentally limited by the capacitance between the power line and the dielectric cable. Typically, the
20 maximum leakage current is a few mA.

Dry band arcing occurs when the jacket of a polluted ADSS cable becomes completely wet, and then starts to dry out. This is because small lengths of dried-out jacket then have to drop very high
25 potentials. At this point, arcing can occur. It is important to realise that the arc roots on the wet pollutant, since this forms the path of least electrical resistance. The temperature of the root of the arc is therefore limited by the boiling point of
30 water. It is the heat radiated from these arcs that can be sufficient to destroy the jacket in the dry band.

The problem of dry band arcing is particularly severe at those points along the ADSS cable where it
35 is attached to a tower. This is because the

capacitive coupling between the power line and the ADSS cable means that the coupled currents are at a maximum at these points. Also, leakage currents of a few mA are particularly destructive. This is because
5 such leakage currents are too low quickly to dry out the surface of the cable through Ohmic heating, yet still high enough that arcs contain sufficient energy to damage the dielectric cable.

To address this problem, many solutions have been
10 proposed. A number of these are outlined in "Arc Control Devices for use on All-Dielectric Self-Supporting Optical Cables" by C.N. Carter, IEEE Proceedings-A, Vol. 140, No. 5 (September 1993). As this paper points out, certain materials are
15 particularly resistant to dry band arcing, in particular silicone, because they are non-tracking, heat resistant and hydrophobic. The problem with silicone, however, is that it is not sufficiently mechanically robust to be used as a cable jacket
20 material.

One proposal discussed in the paper is to cover a section of the ADSS cable near the fitting adjacent to the towers with a thin layer of hydrophobic fully degradation resistant material. The idea is that the
25 over sheath will attract dry band arcing and be able to withstand it. However, the paper casts doubt on the ability of a thin over sheath of hydrophobic material to remain undamaged by arc root heating and concludes that the life of such an arrangement would
30 be uncertain.

The paper also discusses the use of a hydrophobic material retrospectively applied to an installed cable in order to prevent, or at least reduce the incidence of, dry band arcing. However, the paper concludes that
35 in practice the length of over sheath required, or the

equivalent number of sheds, is so large as to render the approach impractical.

Finally, the paper discusses the use of an insulator between the fitting and the support.

5 However, the paper concludes that wet insulators do not present an effective barrier to leakage currents; also, the larger cross sectional area of the insulator relative to that of the cable means that it has a lower surface resistance, making the cable the
10 preferred site for electrical activity. Thus, the insulator is of no use in preventing damage to the installed cable through dry band arcing.

The present invention addresses the problem of protecting ADSS cables from damage due to dry band
15 arcing.

According to a first aspect of the present invention, there is provided a system for supporting a dielectric cable adjacent an overhead power line, comprising: a power line support structure
20 substantially at ground potential; a dielectric cable suspended from the support structure and located within an electric field, the surface of the dielectric cable being resistant to electrical tracking; and a suspension member suspending the
25 dielectric cable from the support structure, the suspension member having a insulating linkage arranged in series between the dielectric cable and the support structure, the surface of the insulating linkage being resistant to electrical tracking and adapted to limit
30 the leakage current from the dielectric cable to ground potential, such that any dry band arcing occurring at the dielectric cable or the insulating linkage contains insufficient energy to damage the said dielectric cable or insulating linkage.

35 Placing a high resistance path between the

dielectric cable and earth minimises the total leakage current that can flow. This also reduces the risk of damage through dry band arcing. For example, the typical leakage current to earth across the surface of an ADSS cable held with a prior art metallic strap is a few mA. If a high resistance dielectric material, such as silicone for example, is employed as the surface of an insulating linkage, then the total resistance of the path to earth is increased thus reducing the leakage current from the dielectric cable to ground to about 1mA. Depending on the degree of track resistance, this is approximately the level of leakage current above which the dielectric cable begins to exhibit structural damage through dry band arcing.

Silicone is particularly preferred as it reduces the leakage current to around 0.1mA which is substantially below the leakage current which can cause destruction of the dielectric cable when dry band arcing occurs.

Whilst it is apparent that a surface which is fully resistant to electrical tracking will be most beneficial in withstanding the effect of dry band arcing, benefits still exist even if the low leakage currents are present on an insulating linkage or ADSS cable jacket which is only track resistant. Thus, the term "resistant to electrical tracking" is to be construed to cover both surfaces that are non-tracking and surfaces which are only partially resistant to tracking.

According to a second aspect of the present invention, there is provided a system for supporting a dielectric cable adjacent an overhead power line, comprising a power line support structure substantially at ground potential; a dielectric cable

suspended from the support structure and located within an electric field, the surface of the dielectric cable being resistant to electrical tracking; and a suspension member suspending the dielectric cable from the support structure, the suspension member having an insulating linkage arranged in series between the dielectric cable and the support structure, the surface of the insulating linkage being resistant to electrical tracking and substantially more hydrophobic than the surface of the dielectric cable such that any dry band arcing preferentially occurs at the insulating linkage rather than the dielectric cable.

Because the linkage is more hydrophobic than the surface of the dielectric cable, the linkage dries more quickly than the cable which is preferably an ADSS optical cable. Thus, any dry bands form on the linkage before the cable starts to dry. The consequence of this is that dry band arcing preferentially occurs on the linkage of the suspension member, which is preferably able to withstand indefinitely the effect, or at least to withstand it sufficiently well to allow planned periodic refurbishment or replacement. In this case the degree of track resistance of the ADSS cable is less critical.

An insulator that is sufficiently more hydrophobic than the surface of the dielectric cable will be the preferred site for electrical activity, even though its surface area per unit length may be larger than that of the cable.

Preferably, the surface of the insulating linkage is "shedded". Not only does this shape cause rain water to run off more easily, but the increased surface area (relative to a planar surface) causes

enhanced evaporation. Coupled with the use of a hydrophobic material, the dielectric linkage will dry significantly more quickly than the surface of the dielectric cable. Also, the undersides of the sheds
5 tend to remain dry and the provision of these numerous "dry" areas increases the surface resistance.

In the case where the surface of the insulating linkage is more hydrophobic than the surface of the dielectric cable, it is preferable that the surface of
10 the insulating linkage is ablative. Thus, where dry band arcing occurs, preferentially upon the insulating linkage, the surface of the linkage is ablated to expose fresh insulating linkage surface material which is hydrophobic and free from atmospheric pollutants.

15 The invention also extends to a method of supporting a dielectric cable adjacent an overhead power line, comprising the steps of: supporting the power line from a support structure substantially at ground potential; suspending a dielectric cable from
20 the support structure using a suspension member such that the dielectric cable is located within an electric field generated by the power line, the surface of the dielectric cable being resistant to electrical tracking; and providing an insulating
25 linkage within the suspension member, the insulating linkage being in series between the dielectric cable and the support structure, the surface of the insulating linkage being resistant to electrical tracking and adapted to limit the leakage current from
30 the dielectric cable to ground potential, such that any dry band arcing occurring at the dielectric cable or the insulating linkage contains insufficient energy to damage the said dielectric cable or insulating linkage.

35 In yet a further aspect of the invention, there

is provided a method of supporting a dielectric cable adjacent an overhead power line, comprising the steps of supporting the power line from a support structure substantially at ground potential; suspending a
5 dielectric cable from the support structure using a suspension member such that the dielectric cable is located within an electric field generated by the power line, the surface of the dielectric cable being resistant to electrical tracking; and providing an
10 insulating linkage within the suspension member, the insulating linkage being in series between the dielectric cable and the support structure, the surface of the insulating linkage being resistant to electrical tracking and substantially more hydrophobic
15 than the surface of the dielectric cable such that any dry band arcing preferentially occurs at the insulating linkage rather than the dielectric cable.

It will be understood that, whilst either a material exhibiting enhanced hydrophobicity or a
20 material providing a high resistance path to ground can be employed as an insulating linkage, and advantages will accrue, a material combining both these properties (such as silicone) will be even more advantageous.

25 According to a further aspect of the present invention, there is provided a method of mounting a dielectric cable on an overhead power line, comprising placing a sleeve around a mandrel, the mandrel defining an aperture therethrough to receive a
30 dielectric cable; locating the mandrel and sleeve in fixed relation to the power line support structure; urging the dielectric cable through the aperture in the mandrel; withdrawing the mandrel from the sleeve when the dielectric cable has been urged through the
35 aperture in the mandrel, such that the sleeve encases

the dielectric cable; and removing the mandrel from the dielectric cable.

5 This aspect of the invention allows the cable to be encased by the sleeve without having to split the latter. Particularly if the sleeve is formed of an elastomeric material, the protection afforded to the surface of the material is improved.

10 Preferably, the mandrel and sleeve are located immediately adjacent (or at least close to) the power line support structure. In that case, the method may further comprise the steps of supporting the dielectric cable from the power line support structure with a suspension member, a first end thereof being affixed to the power line support structure, and a
15 second end thereof being affixed around the surface of the dielectric cable.

Traditionally, a metal strap has been used to suspend the ADSS cable from the power line support structure. This is bolted or otherwise attached to the
20 power line support structure at one end, and has a helical arrangement at the other end to cradle and grip the ADSS cable without damaging its surface integrity.

25 The sleeves must have surface properties equivalent to those of the insulating support member i.e. be hydrophobic, heat and track resistant, and adapted to limit the leakage current from the dielectric cable to ground potential, such that any dry band arcing occurring at the dielectric cable or
30 at the sleeve contains insufficient energy to damage the dielectric cable or sleeve. In addition, the sleeves are preferably substantially more hydrophobic than the surface of the dielectric cable such that any dry band arcing occurs on the sleeve rather than the
35 dielectric cable. In this case, the sleeves are

preferably able to withstand the effect indefinitely.

The sleeves installed according to the above method could be used in combination with an insulating support member. More usually, however, either
5 insulating sleeving or an insulating support member would be used. Largely, the choice depends upon the electrical status of the power line support structure to which the ADSS optical cable is to be attached, and
10 the relative ease with which the arrangements can be installed. In general, the installation of the insulating support member is more straightforward and the installation technique will be more familiar to linecrew.

On the other hand, for safety reasons, it may be
15 preferable to employ the sleeves instead if, for example, access to a tower peak is required under live line conditions. In this case, depending upon the construction of the tower, ungrounded ADSS fittings may be precluded by Safety Rules. In fact, the use of
20 sleeves improves the level of safety by further isolating the ADSS cable from the tower. Of course, for the reasons stated above, if the Safety Rules preclude the climbing of towers or poles without first cutting off the supply of power to the power line
25 carried by that tower, then the use of insulating support members is preferred.

The invention may be put into practice in a number of ways, one of which will now be described by way of example only and with reference to the
30 accompanying Figures, in which:-

Figure 1 shows a schematic drawing of overhead power line towers carrying overhead power lines and an ADSS optical cable;

Figure 2 shows a close-up of the region marked A
35 in Figure 1;

Figure 3 shows a close-up of the region marked B in Figure 1;

Figure 4 shows a close-up of the region marked C in Figure 1;

5 Figure 5a shows, schematically, an arrangement for installing and sleeving an ADSS optical cable;

Figure 5b shows a close up of the region marked D in Figure 5a, including a sleeving installation assembly;

10 Figure 6 shows a close-up side view of the sleeving installation assembly of Figure 5b;

Figure 7 shows a sectional view of the sleeving installation assembly of Figure 6; and

15 Figure 8 shows a side view of a sleeved ADSS optical cable.

Referring first to Figure 1, three of a series of towers 10, 10' are shown schematically. The towers carry high tension power lines. Although it will be readily appreciated by the skilled person that the towers 10, 10' in reality carry a plurality of such high tension power lines, including a live and a neutral line, only one such power line 20 is shown in Figure 1 for the sake of clarity.

20 The power line 20 is suspended from the towers 10, 10' by insulating members (not shown). As will be familiar to those skilled in the art, such insulating members typically include a porcelain insulator to provide a high resistance path to earth from the high tension power line 20.

25 An all dielectric self-supporting (ADSS) optical cable 40 is also held relative to the towers 10, 10'. Such a cable comprises a plurality of optical fibres within a dielectric jacket. In order to maintain the integrity of this outer jacket, it is made of a relatively robust material such as a weather

30

35

resistant, non-tracking or track-resistant polyolefin, preferably of high molecular weight.

Typically, the high tension power line 20 is at a potential of up to about 230kV relative to earth.

5 Thus, the ADSS optical cable 40 sits in a potential gradient between the high tension power line 20 and ground. At the midpoint between two of the towers, the ADSS optical cable sits in a relatively low potential gradient because of the distance between the
10 high tension power line 20 and ground. Towards the towers, however (i.e. at the points where the high tension power lines meet the insulating members) the potential gradient is much larger, as the towers themselves are at earth potential. It is at these
15 points particularly where dry band arcing can occur on the ADSS optical cable 40.

There are a number of ways of supporting the ADSS optical cable 40 relative to the towers. In Figure 1, three such ways are shown schematically.

20 A first tower 10, known as a suspension tower, simply suspends the ADSS optical cable 40 by a suspension member 30 from the metalwork of the tower.

A second tower 10', known as a tension tower (or section tower), is however employed to hold the ADSS
25 optical cable 40 under tension relative to the tower itself, again using a suspension member 30. This latter type of tower is typically used to change the direction of the powerline and is therefore necessary to have a similar arrangement for the ADSS optical
30 cable 40. It is also helpful to employ such a tension tower at regular intervals along the array of towers, to divide the support of the powerline into sections. Likewise it is typical at such towers for the type of support arrangement for the ADSS optical cable to
35 mirror that for the powerline. This reduces the damage

caused to the system if one of the suspension members 30 on a suspension tower 10 breaks.

5 A third tower 10" is also shown in Figure 1. This tower is known as a termination or splice tower, and is employed for connecting an optical cable at ground level to a length of ADSS optical cable suspended in the air between electricity towers.

10 Figure 2 shows, schematically, the region A of Figure 1. In particular, a close up schematic view of the suspension member 30 of a suspension tower 10 is shown. Features common to Figures 1 and 2 are shown with like reference numerals.

15 The suspension member 30 comprises a first end 50 bolted or welded to the tower 10. An insulating linkage 60 is attached to the first end 50 of the suspension member 30. The insulating linkage preferably includes a number of shedded parts 80 which, in addition to increasing the surface area, also allow any rain or moisture to run off the insulator more easily.

20 The end of the insulating linkage 60 distal from the first end 50 of the suspension member 30 carries a preformed suspension fitting 70 for supporting the ADSS cable 40 from the tower 10. It will be appreciated that the distance between adjacent towers is typically several hundred metres or more, and the weight of ADSS optical cable 40 which must be supported by the suspension member 30 is therefore considerable. Therefore, the preformed tension fitting 70 typically includes relatively thick preformed metal wires 90. The preformed wires 90 are threaded through or otherwise attached to a lower end 100 of the insulating linkage 70 and then wrapped around the ADSS optical cable 40. The preformed wires may be wrapped around the ADSS optical cable 40 over a

distance of a metre or more on either side of the insulating linkage in order to provide the necessary support for the cable even in high winds.

Nonetheless, it is important to appreciate that the
5 preformed wires 90 forming a part of the preformed tension fitting 70 lie around the surface of the outer jacket of the ADSS optical cable 40, and the fitting is not designed for insertion into the outer jacket thereof. A clamp type fitting could be employed
10 instead, of course.

Figure 3 shows the region B of Figure 1 in close-up. Here, the manner of suspending an ADSS optical cable 40 under tension from a tension tower 10' is shown. Features common to Figures 2 and 3 are labelled
15 with like reference numerals.

To suspend the ADSS optical cable 40 under tension from the tension tower 10', a suspension member 30' is employed. The suspension member 30' is generally similar to the suspension member 30 of
20 Figure 2, though with some modifications.

A first end 50 of the suspension member 30' is bolted or otherwise affixed to the tension tower 10'. Attached to the first end 50 is an insulating linkage 60 which is preferably similar to the insulating
25 linkage 60 of Figure 2. In particular, the insulating linkage of Figure 3 includes a plurality of sheds 80 to allow water to run off the linkage 60 more readily. Again, the insulating linkage is coated with silicone or another hydrophobic, non-tracking, heat resistant,
30 ablative, material.

At the end of the insulating linkage 60 distal from the tension tower 10' is a tension member shown generally at 200 in Figure 3. The tension member 200 includes a clevis 210 which is held by the insulating
35 linkage 60, and a preformed helical wire 220. The

helical wire 220 is wrapped around the jacket of the ADSS optical cable 40 and grips it firmly.

5 The cable 40 is held under tension relative to the tension tower 10' by attaching the preformed tension member 200 and pulling it towards the tension tower 10'. Once the cable 40 is correctly located, the helical wire 220 of the tension member 200 is secured to the clevis 210.

10 As seen in Figure 3, it is preferable to use two suspension members 30', one on each side of the tension tower 10'. The cable 40 to the left of the tension tower 10' as shown in that Figure is held under tension as is the cable to the right thereof. There is thus a short length of ADSS optical cable 40
15 which hangs under its own weight (i.e. not under tension) between the tension member 200 on each side of the tension tower 10'. This arrangement allows a change in cable direction to be implemented. It also means that, for example, if the cable to the right of
20 the tension tower 10' breaks, the cable to the left of the tension tower 10' will still be supported.

It should be noted that the section of the ADSS optical cable 40 not under tension is also not grounded and that special provision may be needed in
25 the Safety Rules to ensure that this section of cable is not allowed to become hazardous.

Referring now to Figure 4, a close up of the region C of the splice tower 10" in Figure 1 is shown. At the termination tower 10", a tension member 200
30 holds the ADSS optical cable 40 under tension, and is attached to the tower itself via an insulating linkage 60 exactly as with the arrangement of Figure 3 described above. This part of the device will not be described in further detail, therefore.

35 Rather than connecting the ADSS optical cable 40

to the other side of the tower as in Figure 3,
however, here the cable is led down the tower 10" to
ground level. To prevent mechanical strain, the cable
40 is tied to the tower 10" at regular intervals. A
5 shedded sleeve 300 is also employed between the
tension member 200 and the point at which the cable 40
is first tied to the tower 10" since for the reasons
discussed above, it is important equally to reduce the
effect of all leakage currents. This sleeve/cable
10 arrangement has been discussed above and will not be
described in further detail, therefore. In the case of
a terminal tower, the cable passes underground, or may
be spliced to an underground cable; in the case of a
splice tower, the first cable is spliced to a second
15 adjacent cable whose arrangement at the tower mirrors
that of the first.

The insulating linkage 60 of Figures 2, 3 or 4
preferably has two interrelated properties. Firstly,
it has a surface that is heat resistant, partially or
20 fully resistant to electrical tracking and which
minimises leakage currents, for example by having a
surface that is hydrophobic. Therefore, any dry band
arcing which does occur on the linkage 60 has
insufficient energy to damage it. The ADSS dielectric
25 cable 40 also has a track resistant jacket and so
likewise any arc currents on its surface do not cause
damage.

It will be understood that the degree of track
resistance needed for both the insulator 60 and the
30 ADSS jacket depends upon the leakage current limiting
capability of the insulator.

Secondly, the insulating linkage is either
partially or fully resistant to electrical tracking
and has a hydrophobic surface (which therefore tends
35 to limit surface leakage currents). This property

causes the insulating linkage 60 to dry out more quickly than the ADSS optical cable 40, so that any dry band arcing preferentially occurs on the insulating linkage 60 rather than the ADSS optical cable 40.

Although not strong enough to be used as a jacket for the ADSS optical cable 40, silicone is particularly suitable for forming the surface of the insulating linkage 60. Not only is silicone non-tracking (i.e., fully resistant to electrical tracking), it is also extremely hydrophobic.

The Swedish Technical Research Institute have classified various substances in terms of grades of hydrophobicity, from HC1 (high hydrophobicity) to HC7 (low hydrophobicity). Hydrophobicity grades are discussed further in the "Hydrophobicity Classification Guide", published by the Swedish Technical Research Institute (STRI Guide 92/1).

Silicone has further advantageous properties which make it suitable for use as an insulating linkage 60. Firstly, it is highly temperature resistant. This means that any dry band arcing that occurs on the insulating linkage 60 will be readily withstood, up to a current well above that which the ADSS cable could stand. Secondly, silicone can be ablative - that is, if an arc occurs, the surface of the silicone is renewed by being stripped or ablated of a very fine surface layer to leave a clean, (i.e., hydroscopic) non-tracking surface.

The type MIP-16-7 insulator, manufactured by Raychem Corporation, is suitable for the present application. This is an insulator having a silicone sheath, and is able to reduce the leakage current to around 0.1mA, well below the level at which the ADSS cable 40 (or the linkage 60) might be damaged.

Alternatively, the Robosio E00697 type A insulator may be used.

5 Whilst the foregoing has been described with the use of silicone as an insulating linkage 60, it is to be appreciated that the linkage 60 need not have all of the desirable properties outlined above in order to provide significant advantages over the prior art. For example, the use of an insulator 60 which limits the maximum leakage current to a very low value means
10 that the high temperature and track resistant properties of insulator 60 and the jacket of the ADSS optical cable 40 are less critical.

Referring now to Figures 5a, 5b, 6, 7 and 8, a method of installing and oversheathing an ADSS cable
15 will be described.

In Figure 5a, two of a series of towers 10 for carrying high tension power lines 20 are shown. As with Figure 1, only one of the high tension power lines 20 is shown for clarity. As will be understood
20 by the skilled person, the power line 20 is suspended from each tower 10 by insulating power line supports (not shown).

To install an ADSS cable between the towers 10, a pulley block arrangement 410 is first fitted. This
25 arrangement is shown in more detail in Figure 5b and consists of a conventional pulley block adapted to support, on each side, a sleeving installation assembly 415. As may be seen in Figure 5b, the sleeving installation assembly 415 is attached to the
30 pulley block by a clamp 425.

The sleeving installation assembly 415 is itself shown in close up side view in Figure 6 and in cross section in Figure 7. The installation assembly 415 comprises a sleeve 420 supported upon a hollow
35 cylindrical mandrel 440. The sleeve 420 is preferably

of the elastomeric non-heat shrink form which will be familiar to those skilled in the art. Such a sleeve is made of silicone, which is hydrophobic. Furthermore, the sleeve is formed with a number of sheds 430
5 (Figure 6) which allow rain and atmospheric moisture to run off the sleeve 420.

The outer diameter of the mandrel 440 supports the sleeve 420 in an expanded state. The inner diameter of the mandrel, however, is large enough to
10 allow an ADSS optical cable 40, pulling rope and rope/ADSS optical cable coupling to pass through it.

Referring once more to Figure 5a, once the pulley blocks 410 have been fitted to each tower, and an installation assembly 415 has been held by the clamp
15 425 on each side of each pulley block, a pulling rope 450 is drawn over the pulleys. The use of a pulling rope which has been pre-installed over the pulleys will be familiar to those skilled in the art. However, in contrast to the prior art, the pulling rope is pre-
20 installed over the pulleys whilst at the same time being threaded through the bore of the hollow cylindrical mandrels 440. The pulling rope continues to be pulled through successive mandrels 440 at adjacent towers, until the pulling rope 450 has passed
25 along the full span of towers over which the ADSS cable is to be installed. At the end of the run (adjacent the end tower 10) is located a rope take-up drum and tensioner (not shown).

Once the pulling rope has been pre-installed, a
30 first end of the ADSS cable, located adjacent to the first tower 10, is attached to the pulling rope. The rope is then drawn back along the pulleys, through the installation assemblies 415 and onto the take-up drum, dragging the first end of the ADSS cable 40 with it.
35 Once the first end of the ADSS cable 40 reaches the

pulling rope take-up drum, it is connected to a terminator at the ground level. The other, second end of the ADSS cable adjacent the first tower is also cut off and attached to a termination point.

5 Once the correct tension in the ADSS optical cable 40 has been achieved, each mandrel 440 is detached from the pulley block onto which it had been mounted. Next, the ADSS optical cable is raised from the pulley block and connected to the support member
10 at that point. The mandrels 440 are then detached from their associated pulley block by removing them from their respective clamp 425, so that the mandrels are slidable relative to the (now fixed) ADSS cable 40. Next, the pulley blocks 410, as well as the clamps
15 425, are removed from the towers 10. Each mandrel 440 is then slid a short distance away from an adjacent ADSS cable support member, and the sleeve 420 on the mandrel 440 is slipped off. Because the sleeve 420 is elastomeric, it covers and grips the ADSS cable 40 at
20 that point.

 Figure 8 shows a side view of the sleeve 420 following installation. It is desirable that the bore of the sleeve is lined with a mastic or other sealant to prevent moisture ingress along the interface
25 between the sleeve and the ADSS optical cable 40.

CLAIMS

1. A system for supporting a dielectric cable adjacent to an overhead power line, comprising:
 - 5 a power line support structure substantially at ground potential;
 - a dielectric cable suspended from the support structure and located within an electric field, the surface of the dielectric cable being resistant to electrical tracking; and
 - 10 a suspension member suspending the dielectric cable from the support structure,
 - the suspension member having a insulating linkage arranged in series between the dielectric cable and the support structure, the surface of the insulating linkage being resistant to electrical tracking and adapted to limit the leakage current from the dielectric cable to ground potential, such that any dry band arcing occurring at the dielectric cable or the insulating linkage contains insufficient energy to damage the said dielectric cable or insulating linkage.
 - 15
 - 20
2. The system of Claim 1, in which the surface of the insulating linkage is adapted to limit the leakage current from the dielectric cable to ground to no more than 1mA.
- 25
3. The system of Claim 2, in which the surface of the insulating linkage is adapted to limit the leakage current from the dielectric cable to ground to no more than 0.1mA.
- 30
4. A system for supporting a dielectric cable adjacent an overhead power line, comprising:
- 35

a power line support structure substantially at ground potential;

5 a dielectric cable suspended from the support structure and located within an electric field, the surface of the dielectric cable being resistant to electrical tracking; and

a suspension member suspending the dielectric cable from the support structure,

10 the suspension member having a insulating linkage arranged in series between the dielectric cable and the support structure, the surface of the insulating linkage being resistant to electrical tracking and substantially more hydrophobic than the surface of the dielectric cable such that any dry band arcing
15 preferentially occurs at the insulating rather than the dielectric cable.

5. The system of any one of the preceding claims, in which the surface of the insulating linkage is
20 ablative and renewable.

6. The system of any one of Claims 1 to 5, in which the insulating linkage is at least partly formed from
25 silicone.

7. The system of any of Claims 1 to 6, in which the surface of the insulating linkage is shedded.

8. The system of any one of Claims 1 to 7, in which
30 the dielectric cable is an all dielectric self supporting (ADSS) optical cable.

9. A method of supporting a dielectric cable
35 adjacent an overhead power line, comprising the steps of:

supporting the power line from a support structure substantially at ground potential;

5 suspending a dielectric cable from the support structure using a suspension member such that the dielectric cable is located within an electric field generated by the power line, the surface of the dielectric cable being resistant to electrical tracking; and

10 providing an insulating linkage within the suspension member, the insulating linkage being in series between the dielectric cable and the support structure, the surface of the insulating linkage being resistant to electrical tracking and adapted to limit the leakage current from the dielectric cable to
15 ground potential, such that any dry band arcing occurring at the dielectric cable or the insulating linkage contains insufficient energy to damage the said dielectric cable or insulating linkage.

20 10. A method of supporting a dielectric cable adjacent an overhead power line, comprising the steps of:

supporting the power line from a support structure substantially at ground potential;

25 suspending a dielectric cable from the support structure using a suspension member such that the dielectric cable is located within an electric field generated by the power line, the surface of the dielectric cable being resistant to electrical
30 tracking; and

providing an insulating linkage within the suspension member, the insulating linkage being in series between the dielectric cable and the support structure, the surface of the insulating linkage being
35 resistant to electrical tracking and substantially

more hydrophobic than the surface of the dielectric cable such that any dry band arcing preferentially occurs at the insulating linkage rather than the dielectric cable.

5

11. A method of mounting a dielectric cable on an overhead power line support structure, comprising:

10 placing a sleeve around a mandrel, the mandrel defining an aperture therethrough to receive a dielectric cable;

locating the mandrel and sleeve in fixed relation to the power line support structure;

urging the dielectric cable through the aperture in the mandrel;

15 withdrawing the mandrel from the sleeve when the dielectric cable has been urged through the aperture in the mandrel, such that the sleeve encases the dielectric cable; and

20 removing the mandrel from the dielectric cable.

20

12. The method of claim 11, in which the sleeve is formed of a hydrophobic elastomer, such that withdrawal of the mandrel from the sleeve causes the sleeve elastically to grip the dielectric cable.

25

13. The method of claim 11 or claim 12, in which the mandrel and sleeve are located immediately adjacent to the power line support structure.

30

14. The method of claim 13, further comprising the step of:

35 supporting the dielectric cable from the power line support structure with a suspension member, a first end thereof being affixed to the power line support structure, and a second thereof being affixed

round the surface of the dielectric cable.

15. The method of claim 14, in which the sleeve encases the second end of the suspension member once the mandrel is withdrawn from the sleeve.

16. A system for supporting a dielectric cable adjacent an overhead power line substantially as described herein with reference to the accompanying drawings.

17. A method of supporting a dielectric cable adjacent an overhead power line substantially as described herein with reference to the accompanying drawings.

18. A method of mounting a dielectric cable on an overhead power line support structure substantially as herein described with reference to the accompanying drawings.

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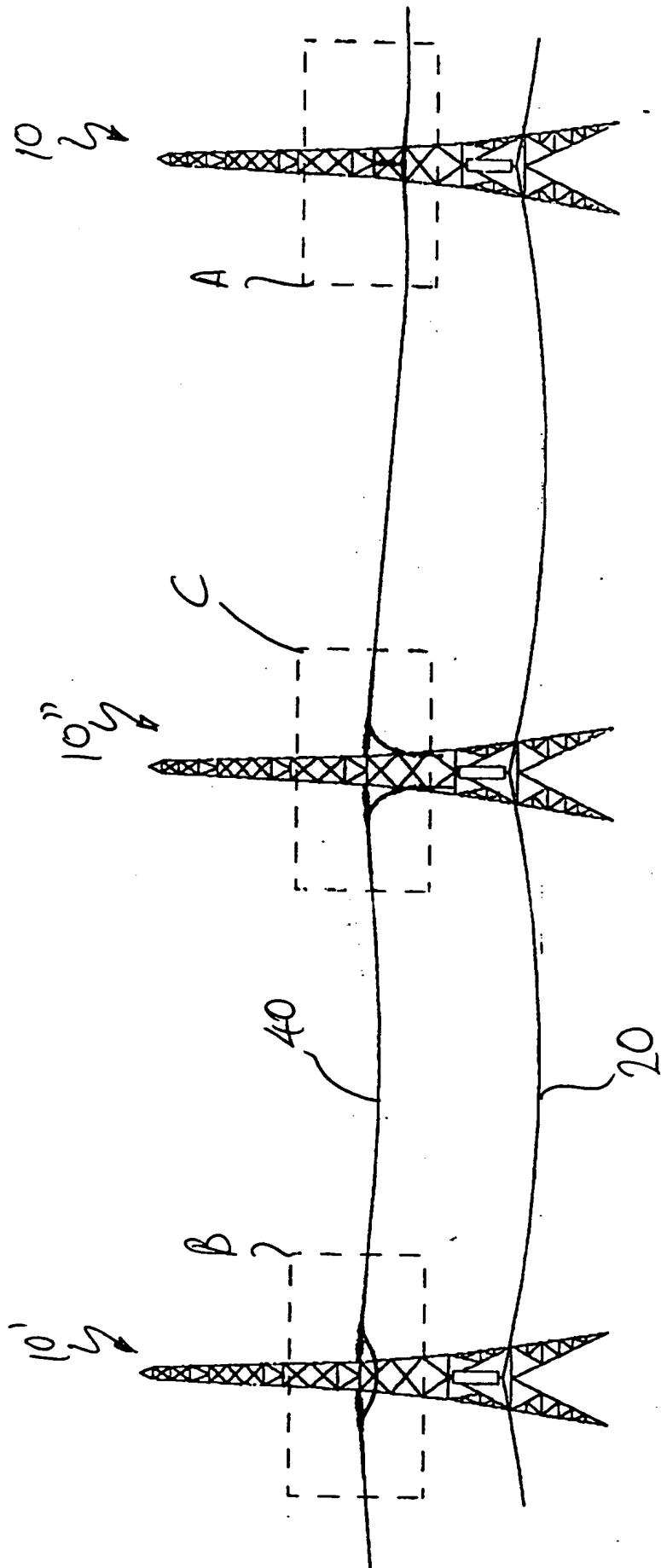


FIG. 1

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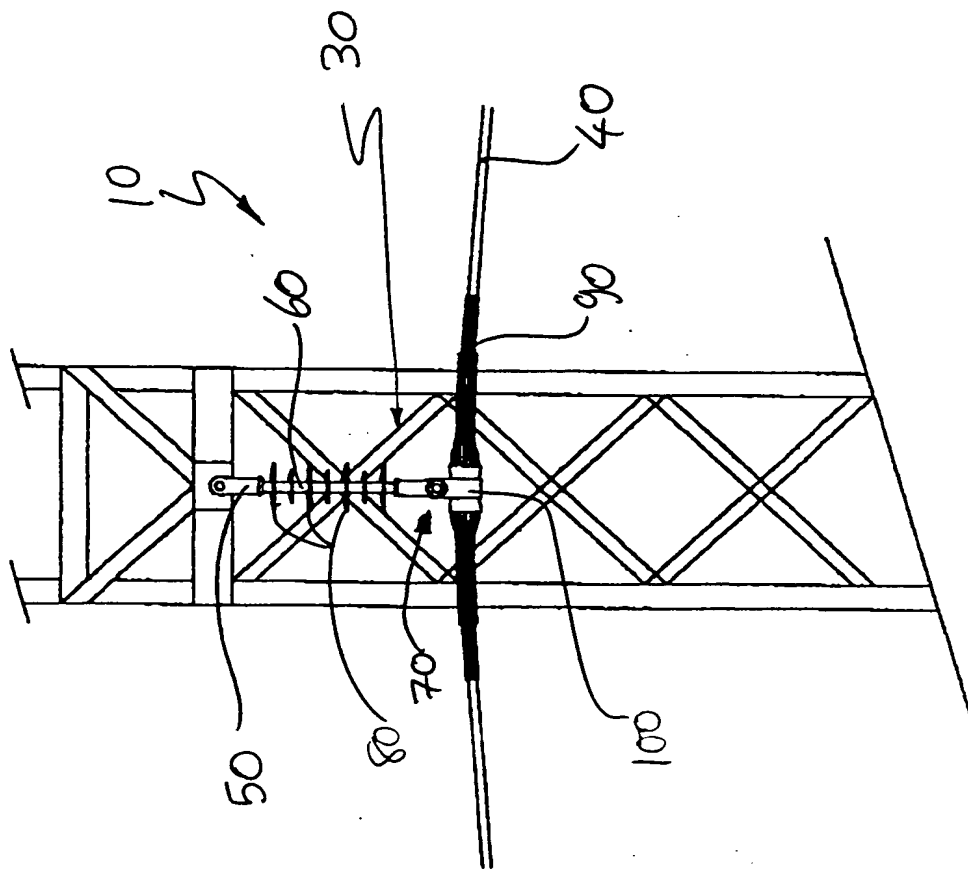


Fig 2

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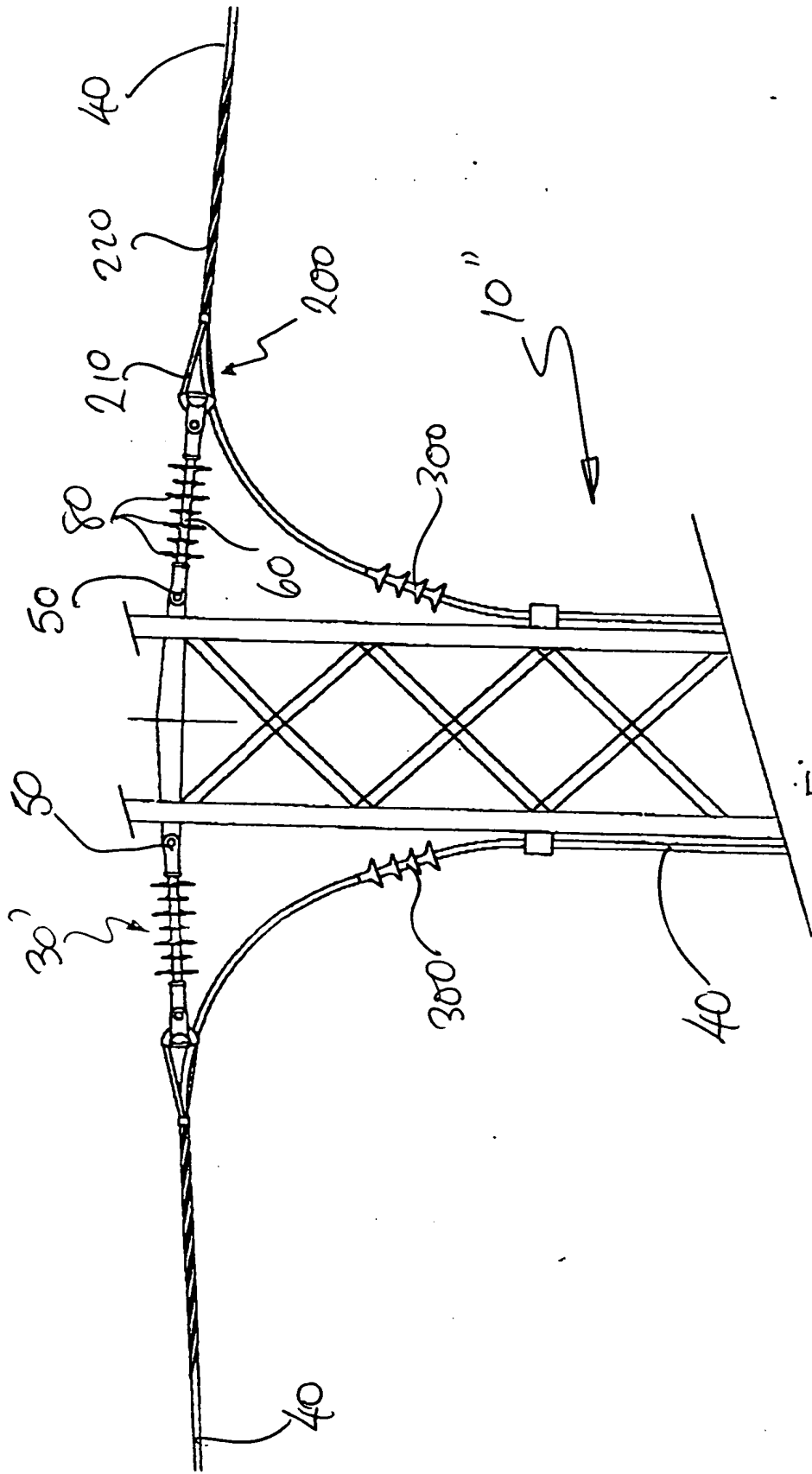


Fig 4

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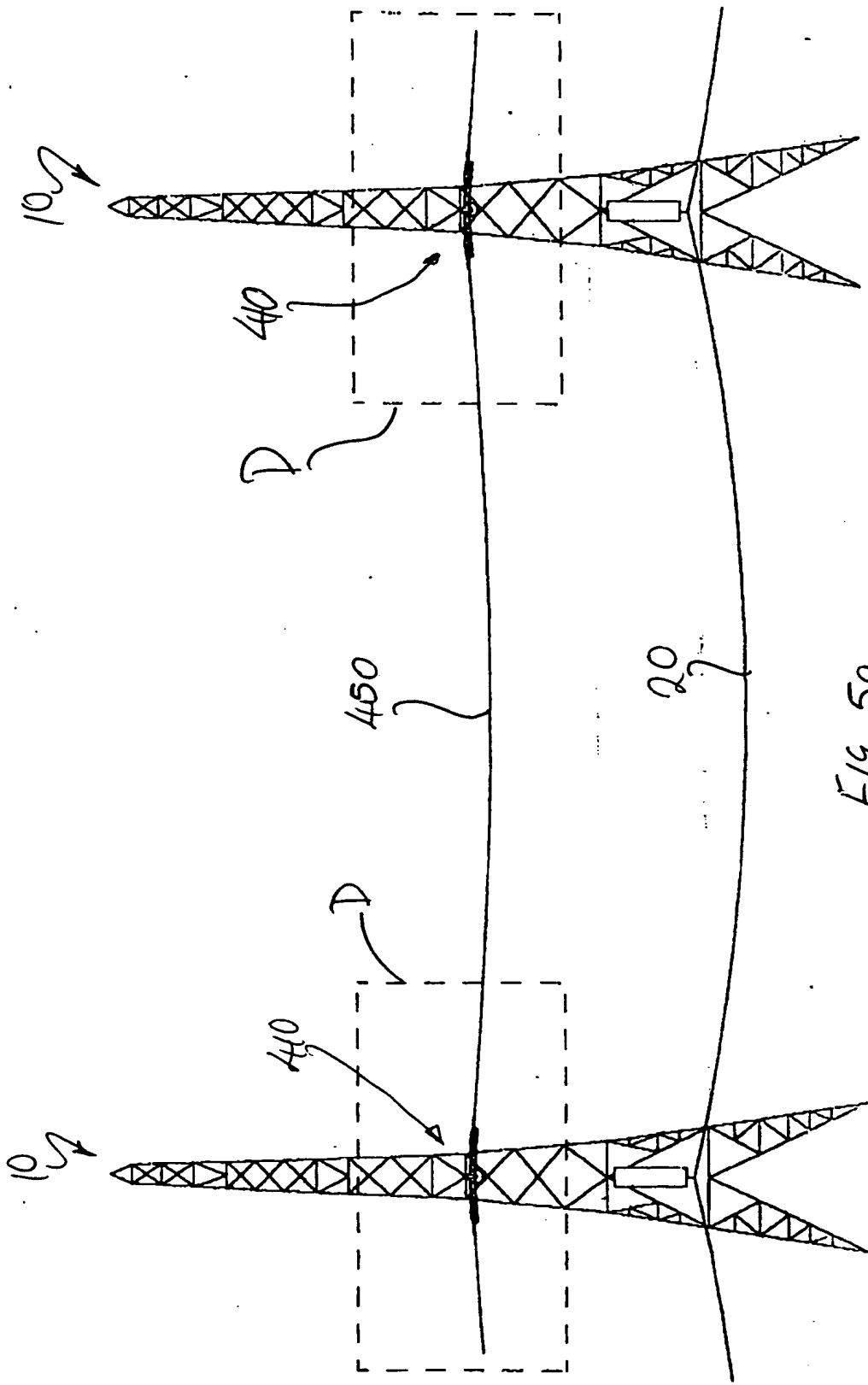


Fig. 5a

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410

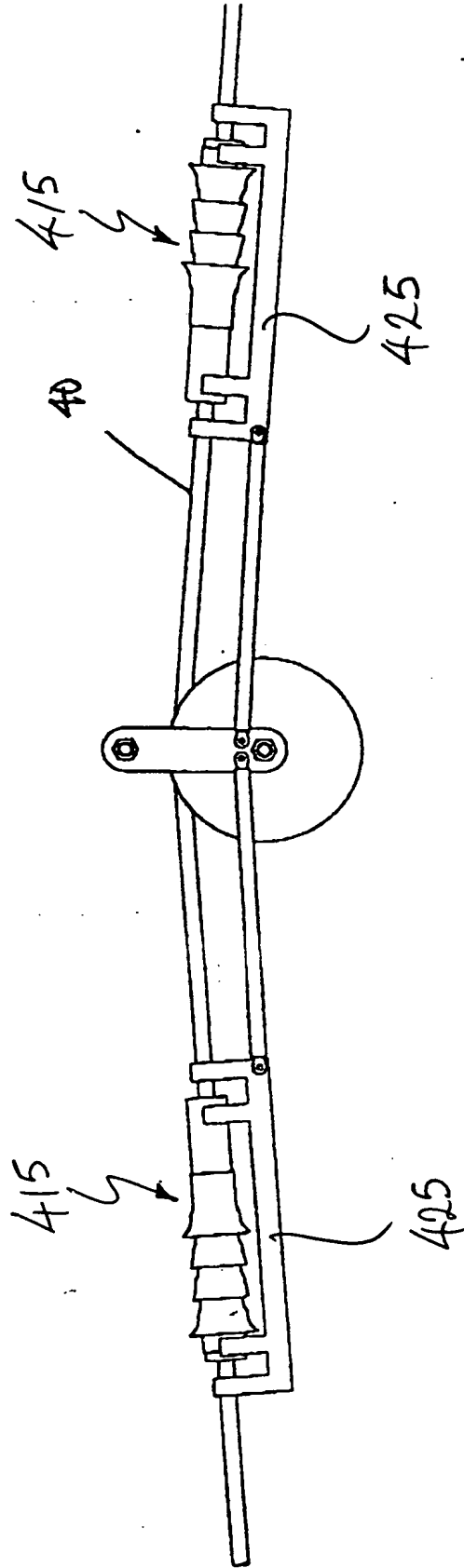


Fig 5b

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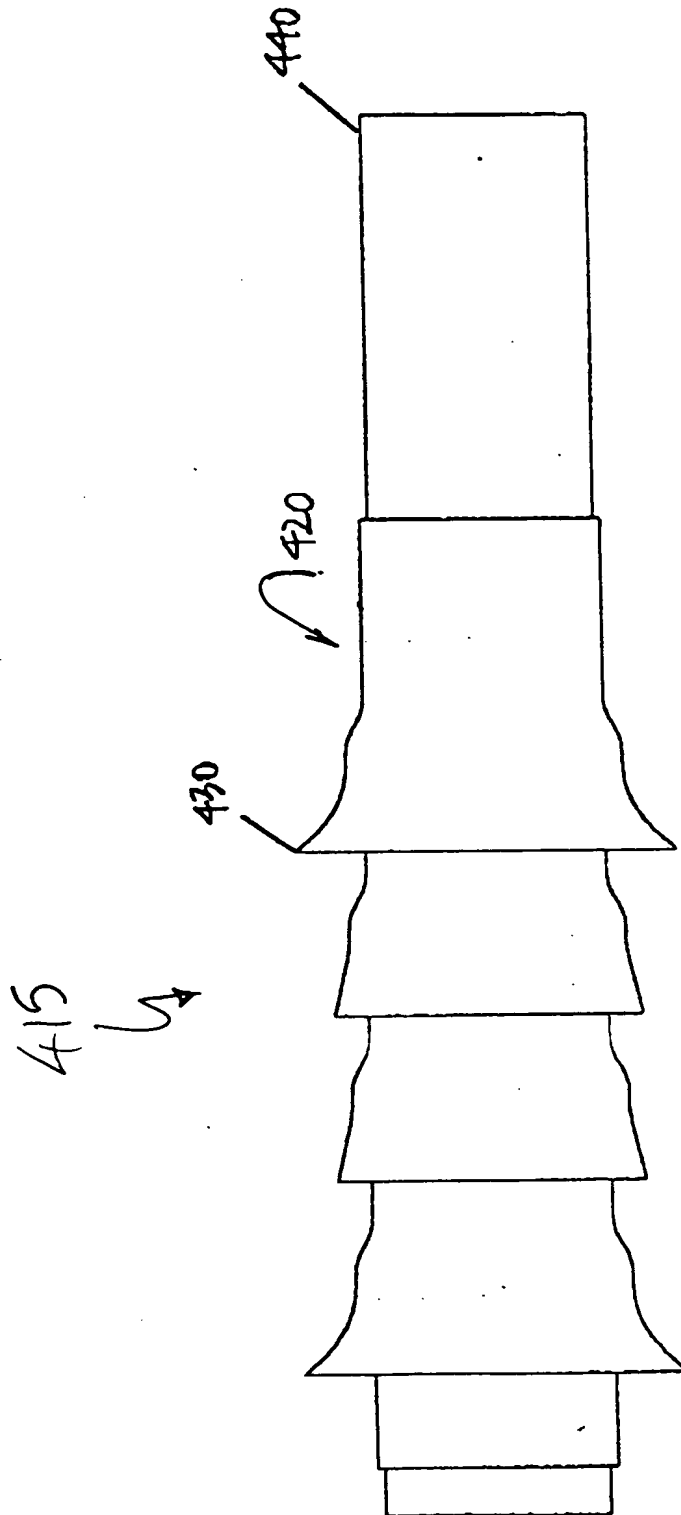


Fig 6

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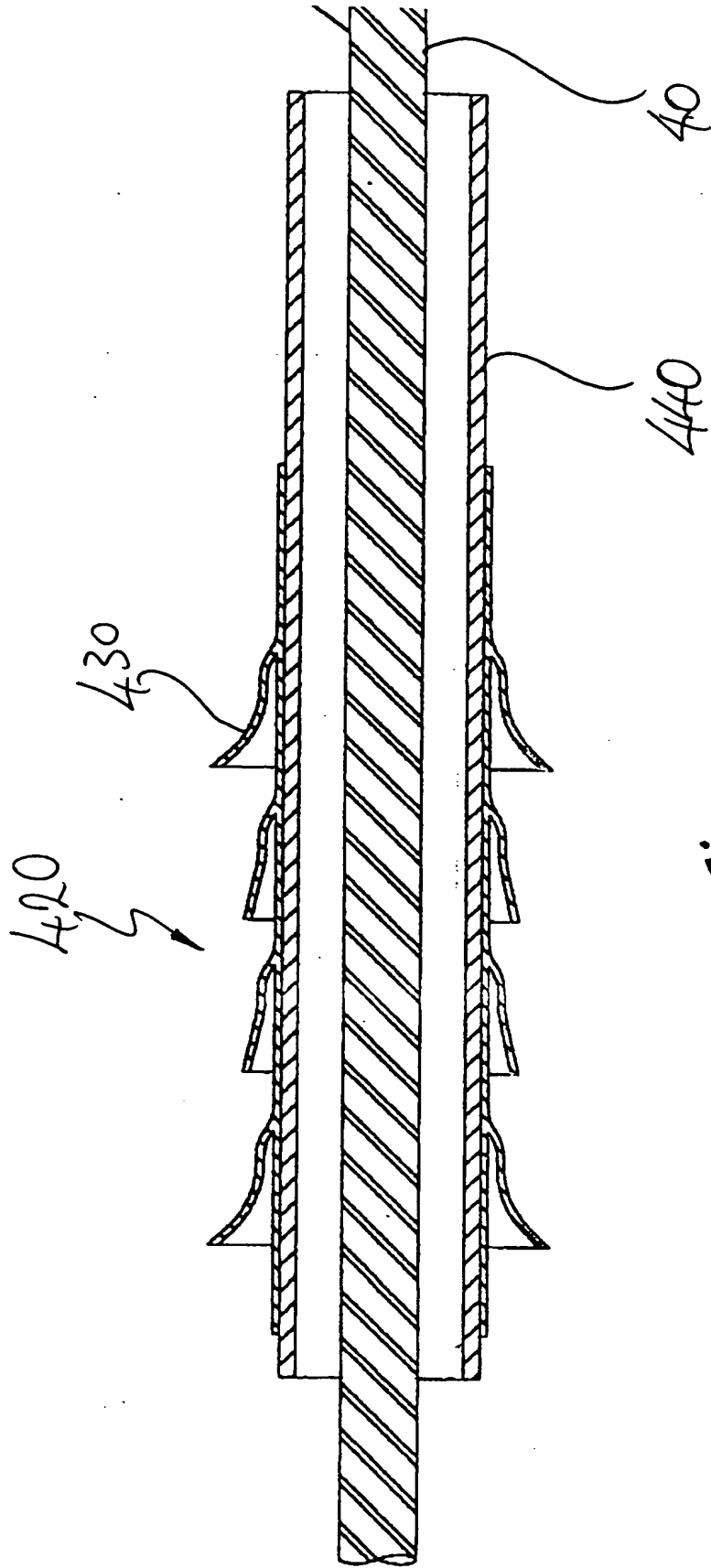


Fig. 7

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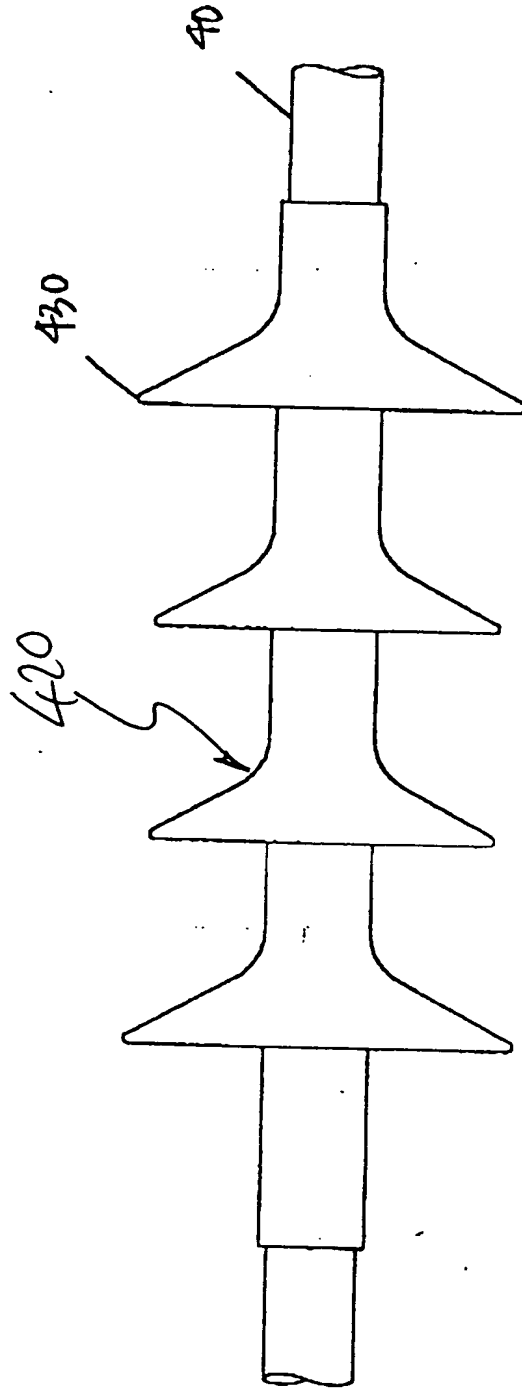


Fig 8

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